

REMARKS

Claims 1–36 are pending, with claims 1 and 19 being independent. Claims 7, 8 and 19–36 have been amended. Claims 37–54 have been added, with claim 37 being independent. Reconsideration and allowance of the above-referenced application are respectfully requested.

Allowable Subject Matter

Claims 7–9 and 14–18 have been objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Applicant respectfully reserves the right to rewrite these claims at a later time. In addition, it is noted that claims 7, 8, 25 and 26 have been amended to correct typographical errors, and not to change the scope of the claimed subject matter.

Rejections Under 35 U.S.C. § 101

Claims 19–36 are rejected under 35 U.S.C. § 101 because the claimed invention is allegedly directed to non-statutory subject matter. Without conceding the propriety of the rejection, claims 19–36 have been amended to include, “computer readable medium”, as suggested by the Examiner. These amendments have been made to expedite prosecution. Thus, withdrawal of the rejection under 35 U.S.C. § 101 is respectfully requested.

Rejections Under 35 U.S.C. § 102

Claims 1–6, 10–12, 19–24 and 28–30 stand rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by U.S. Patent No. 5,640,200 issued to Michael (hereinafter “Michael”). This contention is respectfully traversed.

Claim 1 is directed to a method for classifying elements of a digital image. The method comprising: receiving an element of the digital image and a prototype representing a class of elements; generating a difference image representing differences between the received element and the prototype and including a plurality of ON pixels, each ON pixel representing a local difference between the received element and the prototype, wherein the difference image

includes one or more clusters of ON pixels, each cluster including one or more neighboring ON pixels; determining relative arrangements of ON pixels in the difference image; assigning one or more scores to the difference image using the determined relative arrangements of ON pixels in the difference image; and based on the scores assigned to the difference image, determining whether the received element of the image belongs to the class represented by the prototype.

Michael describes a golden template comparison using efficient image registration. As described in Michael's Summary of the Invention:

Golden Template Comparison (GTC) is a method that can be applied to flaw and defect detection in images of 2-dimensional scenes that do not suffer from geometric distortion. A test image is compared to a golden template image that is the mean of a plurality of good sample images. To perform the comparison, the test image and the golden template image must be registered, and then subtracted. The resulting difference image is then analyzed for features that indicate flaws or defects.

See Michael at col. 3, lines 45–53. The basic idea of GTC is to compare a test image to a statistical composite image of a known good scene by subtracting the test image from the statistical composite image (golden template) and then looking for significant differences between the two images. *See Michael* at col. 10, lines 35–39. The difference image is calculated only after the test image and golden template image are first registered and then subtracted.

Registration of a pair of objects shall be defined as orienting a first object with respect to a second object so as to make all alignment parameters of the first object substantially equal to the corresponding alignment parameters of the second object.

See Michael at col. 2, lines 6–10. The golden template image is created using a statistical computation from an ensemble of various acceptable sample images, each of which is representative of correct or passing criteria. *See Michael* at col. 9, lines 43–45 and at col. 10, lines 4–6 (emphasis added).

In contrast, claim 1 recites, “receiving an element of the digital image and a prototype representing a class of elements” (emphasis added). In digital image processing compression

techniques, repeated or closely resembling image elements are identified and assigned to classes. *See e.g.*, Background, page 1, lines 26–28. Each class has a prototype, i.e., a symbol that is used to represent essential features of members of the class. *See e.g.*, Detailed Description, page 5, lines 28–29. Prototypes representing a class of elements can include preset character glyphs stored in a symbol memory or generated from repeated characters in the image. *See e.g.*, Detailed Description, page 5, line 26 to page 6, line 3. Thus, the citation to Michael's golden template for purportedly anticipating prototypes representing a class of elements is, with all due respect, incorrect in view of the plain meaning of “prototype representing a class of elements.”

Michael does not disclose a prototype representing a class of elements, instead, Michael discloses creating a golden template image created from an ensemble of various acceptable images using a statistical computation. *See Michael* at col. 9, lines 43–45. Michael's golden template is a statistical composite image generated from various sample images, each of which is representative of correct or passing criteria, so as to reduce variations and noise and obtain an accurate difference image after registration and subtraction of the test image and the golden template. *See Michael* at col. 10, lines 35–39, and col. 14, lines 43–53. Wherefore a prototype is, i.e., a symbol representing a class of elements, a golden template is a composite image generated by taking the statistical average of a plurality of acceptable comparative images. This is completely different subject matter than a method for classifying elements of a digital image comprising receiving an element of the digital image and a prototype representing a class of elements. Thus, Michael fails to teach or suggest each and every element of claim 1, and therefore, independent claim 1 should be allowable over Michael for at least this reason.

Independent claim 19 is directed to a computer readable medium storing a software product for classifying elements of a digital image. The software product comprising instructions operable to cause one or more data processing apparatus to perform operations comprising: receiving an element of the digital image and a prototype representing a class of elements; generating a difference image representing differences between the received element and the prototype and including a plurality of ON pixels, each ON pixel representing a local difference between the received element and the prototype, wherein the difference image includes one or more clusters of ON pixels, each cluster including one or more neighboring ON

pixels; determining relative arrangements of ON pixels in the difference image; assigning one or more scores to the difference image using the determined relative arrangements of ON pixels in the difference image; and based on the scores assigned to the difference image, determining whether the received element of the image belongs to the class represented by the prototype. Therefore, independent claim 19 should be allowable for at least the same reasons set forth above with respect to claim 1.

Independent claim 37 is directed to a system comprising one or more processors and one or more computer readable mediums storing a software product for classifying elements of a digital image. The software product comprising instructions operable to cause the one or more processors to perform operations comprising: receiving an element of the digital image and a prototype representing a class of elements; generating a difference image representing differences between the received element and the prototype and including a plurality of ON pixels, each ON pixel representing a local difference between the received element and the prototype, wherein the difference image includes one or more clusters of ON pixels, each cluster including one or more neighboring ON pixels; determining relative arrangements of ON pixels in the difference image; assigning one or more scores to the difference image using the determined relative arrangements of ON pixels in the difference image; and based on the scores assigned to the difference image, determining whether the received element of the image belongs to the class represented by the prototype. Therefore, independent claim 37 should be allowable for at least the same reasons set forth above with respect to claim 1.

Claims 2-6, 10-12, 20-24, 28-30 and 38-54 depend from claims 1, 19 or 37 and should be allowable for at least the same reasons as their respective independent claims, and based on the additional recitations they contain.

For example, claims 4, 22 and 40 recite, "wherein: assigning one or more scores to the difference image includes assigning a score to each cluster based on the shape of the cluster." The only evidence provided in support of the rejections of this subject matter is a bare citation to Michael column 10, lines 28-34, column 16, lines 15-32, and equations 9a and 9b, none of which describe assigning a score to each cluster based on the shape of the cluster. Rather, Michael discloses a count of defect pixels found during a blob analysis and provides two

methods for imposing defect criteria based on shape—one is based on geometrical measurements and the other is based on gray-scale mathematical morphology. *See Michael* at col. 10, lines 28–34 and at col. 16, lines 15–18. Neither the blob analysis, nor the methods for imposing defect criteria assign scores to each cluster in the difference image based on the shape of the cluster. *See e.g.*, Detailed Description, page 7, lines 11–12. Moreover, equations 9a and 9b have no relevance in assigning one or more scores to the difference image including assigning a score to each cluster based on the shape of the cluster, and instead relate to calculating the error image—an image resulting in the comparison of Michael's difference image with a standard-deviation-computed threshold image. *See Michael* at col. 10, lines 21–27 and at col. 16, lines 21–24. Therefore, because Michael does not teach or suggest assigning one or more scores to the difference image including assigning a score to each cluster based on the shape of the cluster, claim 4, claim 22 and claim 40 should be allowable for at least these additional reasons.

Rejections Under 35 U.S.C. § 103

Claims 13 and 31 are rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Michael. The rejection is based on Official Notice of the equivalence of using a subtraction operation and an exclusive-or operation for use in the electrical engineering art. This contention is respectfully traversed.

In the present application, the difference image is generated, for example, by performing a Boolean exclusive-or operation of each pixel of the bitmap image element with the bitmap of the prototype. Michael describes generating a difference image from multi-bit pixels by subtracting the first image from the second image, or vice versa. *See Michael* at col. 8, lines 57–59. The use of a Boolean exclusive-or operation and the use of a subtraction operation provide equivalent results when generating a difference image between two one-bit pixels, as described in claims 13 and 31 where each bit of the two bitmap images represents a single pixel in the source. However, when generating a difference image between two multi-bit pixels, as described by Michael, the Boolean exclusive-or operation and subtraction operation do not provide equivalent results. *See Michael* at col. 8, lines 57–59 and at col. 10, lines 21–22. For example: (00010101) compared to (00001010) = (00001011) [with subtraction operation], but (00011111)

[with Boolean exclusive-or operation]. Thus, generating a difference image by performing a Boolean exclusive-or operation of each pixel of the bitmap image element with the bitmap of the prototype would not have been obvious to one having ordinary skill in the art using a subtraction operation to generate a difference image between multi-bit pixels, as described in Michael, because the results are not equivalent.

Furthermore, Michael should not be read as rendering the present application nonobvious because the subject matter sought to be patented in the present application and the prior art cited by the Office exist in entirely different fields of the electrical engineering arts. The present application relates to the field of digital image processing. Conversely, Michael relates to machine vision, and particularly to flaw and defect detection based on comparison of digitized images acquired by a machine vision system. *See Michael* at col. 1, lines 13–16. More specifically, Michael relates to microelectronic and semiconductor fabrication and teaches alignment and/or registration techniques in mask registration, stepping, dicing, die picking, die bonding, wire bonding, and optical inspection. *See Michael* at col. 1, lines 20–28 and at col. 2, lines 10–17. Although both the present application and Michael may be generally categorized within the rubric of electrical engineering arts, they reside in vastly different fields.

Michael's machine vision is a subfield of electrical engineering which often requires digital input/output devices, computer networks and manufacturing equipment, whereas the digital image processing subfield consists of processing digital data that represents graphics objects. *See e.g.*, Background, page 1, lines 4–7. Digital image processing does not require computer networks to control and operate manufacturing equipment as required in machine vision systems. Thus, the present application is nonobvious in light of Michael as Michael does not teach, suggest or motivate one in the field of digital image processing to look to the field of machine vision, including microelectronic and semiconductor fabrication, for generating difference images by performing a Boolean exclusive-or operation of each pixel of the bitmap image element with the bitmap of the prototype. Therefore, claims 13 and 31 should be allowable over Michael for at least these reasons.

Claim 49, which discloses subject matter similar to claims 13 and 31, recites, "wherein: generating a difference image includes performing a Boolean exclusive-or operation of each

pixel of the bitmap image element with the bitmap of the prototype.” Therefore, claim 49 should be allowable over Michael for at least the same reasons set forth with respect to claim 13 and claim 31.

CONCLUSION

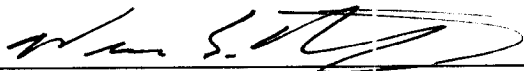
The foregoing comments made with respect to the positions taken by the Examiner are not to be construed as acquiescence with other positions of the Examiner that have not been explicitly contested. Accordingly, the above arguments for patentability of a claim should not be construed as implying that there are not other valid reasons for patentability of that claim or other claims.

In view of the amendments and remarks herein, Claims 1–54 should be in condition for allowance. A formal notice of allowance is respectfully requested.

Please apply the \$900 extra claim fee, and any other charges or credits, to deposit account 06-1050.

Respectfully submitted,

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